Heart and Vascular Health for Cyclists: Screening & Management from Juniors to Masters Athletes

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Disclosures
I have no disclosures.

Objectives
1. Review issues / clinical cases
2. Understand cardiac screening guidelines/practice
3. Apply cardiovascular care guidelines
4. Provide resources

Classification of Sports – Peak Dynamic and Static Components Achieved During Competition

Junior or Masters Considerations
+ Age < 35 years
  1. Congenital risk
  2. Acquired risk
+ Age > 35 years
  1. Acquired risk
    Atherosclerotic Coronary Artery Disease (CAD)
  2. Congenital risk

Exercise Physiology

Goals for Screening - All Ages

Risk Stratification + Risk Management

Normal
- Ok to participate

Abnormal
- Further evaluation, assessment, consideration

Cardiac Arrest
Sudden Cardiac Death (SCD)

- The heart abruptly stops pumping
- Ventricular fibrillation occurs instantly, stops regular heart beats, makes a person faint
- 88% of cardiac arrests occur at home
- < 8% who suffer cardiac arrest outside the hospital survive*

*Increased survival in running events has been reported:
  Increased survival in Out of Hospital Cardiac Arrest (OHCA) youth (< 35 years old)

MLS: Heart screenings more personal for Crew
Sunday February 24, 2013

Challenges for SCD prevention in athletes

- Rare incidence (1 per 200K per year), but highly visible and emotional events
- Wide spectrum of etiologies (or spontaneous)
- Basic screening (history and exam) applied inconsistently and incompletely
- Advanced screening (EKG and Echo) expensive, associated with false + and false -
- Inconsistent data from observational studies

57 year old referred for murmur

- Active cyclist for years, has completed TOSRV tours multiple times, rides in hilly southeastern Ohio

57 year old referred for murmur

- Asymptomatic
- Physical exam ~ tall thin habitus, regular S1 S2, diminished A2, +systolic click, harsh systolic ejection murmur III/VI, radiates to neck, vascular exam symmetric pulses, carotids parvus et tardus
- ECG Sinus bradycardia, voltage criteria LVH
57 year old cyclist

- Echocardiogram ~ LVH, Normal LV ejection fraction; bicuspid aortic valve with severe stenosis, normal aorta

### Bicuspid Aortic Valve (BAV)

**Most common congenital heart condition ~ Valvulaoartopathy**

- DaVinci described > 500 years ago
- Estimated prevalence 0.5-2%
- Varied phenotypes ~ stenosis, insufficiency
- Bacterial endocarditis risk
- Aortic dissection risk
- Familial presentation 9% prevalence BAV in 1st degree relatives


### Normal and Bicuspid Aortic Valve Schematics


### Bicuspid Aortic Valve Imaging

A. Transesophageal echo (TEE) short-axis view bicuspid aortic valve
B. TEE 3D view fish mouth appearance
C. Transthoracic echo parasternal long axis view bicuspid valve doming
D. MRI sagittal oblique view showing dilated ascending aorta


### Risk Factors for CAD

- Not controllable or modifiable risk factors
  - Heredity
  - Gender
  - Age

- Controllable or modifiable risk factors
  - Smoking
  - High Blood Cholesterol
  - High Blood Pressure
  - Obesity
  - Physical Inactivity
  - Stress and Behavior

### Your Heart May Be Older Than You Are

- **Take to Heart ~ Heart-risk-assessment tools gauge a person’s risk for an adverse cardiovascular event:**
  - Chronologic age: As people get older, the heart muscle can stiffen, reducing pumping efficiency. Valves also might deteriorate.
  - Blood pressure: Hypertension puts more strain on the heart, making it pump harder.
  - Cholesterol: A buildup of plaque narrows the blood vessels, forcing the heart to work harder to circulate blood around the body.
  - Waist circumference: A large waist can indicate high levels of visceral, or organ, fat, which represents a greater risk for cardiovascular conditions than fat found under the skin or around muscles.
  - Gender: Because of hormonal differences, women tend to develop heart disease roughly 10 years later than men.

American Heart Association; Heart Age
Cardiovascular Care of the Athlete—Athlete’s Heart

- Cardiac Enlargement: Physiological Adaptation to exercise vs Pathology
- Ventricular enlargement/thickness
- Atrial
  - Aorta — Aortic root dimension 40 mm in highly conditioned male athletes (and 34 mm in female athletes) is uncommon, is unlikely to represent the physiological consequence of exercise training, and is most likely an expression of a pathological condition, mandating close clinical surveillance*

Baggish AL, Wood MJ. Circulation 2011;123:2723-2735

27 year old professional cyclist referred for palpitations

- Occur when off season, sustained throughout evening with associated feeling of not able to catch breath
- No lightheadedness or syncope
- Physical exam: BP 138/85mmHg left arm, 135/90mmHg right arm, HR 58bpm, unremarkable cardiovascular exam
- ECG Sinus bradycardia
Cardiovascular Care of the Athlete-Issues

Arrhythmia & Conduction Abnormalities
- Premature Beats (atrial and/or ventricular)
- Nonsustained ventricular tachycardia
- Tachyarrhythmias
  - Supraventricular tachycardia (SVT)
  - Atrial fibrillation ~ Most common cardiac arrhythmia

Baggish AL, Wood MJ. Circulation 2011;123:2723-2735

Atrial Flutter (AFL) Atrial Fibrillation (AF)
- Regular long-term endurance sports training may increase the risk for AFL and AF
- AF in athletes is initially paroxysmal, and most episodes have a vagal origin
- Proposed mechanisms in endurance athletes
  - Atrial ectopic beats
  - Inflammatory changes
  - Atrial enlargement with dilatation and fibrosis
  - Increased vagal tone


Atrial Fibrillation, Atrial Flutter Management in Athletes
- Sports Activity Reduction
- Task Force 7, 36th Bethesda Conference Recommendations
- Circumferential Pulmonary Vein Isolation (CPVI)
- Cavotricuspid isthmus ablation

Zipes et al. J Am Coll Cardiol 2005;45:1354-63

Cardiovascular Care of the Athlete-Issues
- Arrhythmia & Conduction Abnormalities
  - Common in trained athletes
  - Bradyarrhythmias
    - Sinus bradycardia
    - Junctional bradycardia
    - First-degree atrioventricular block
    - Mobitz type I atrioventricular block
- Assess symptoms
- Document appropriate chronotropic response to exercise

Baggish AL, Wood MJ. Circulation 2011;123:2723-2735

Incident AF during 12 years of follow-up among 5446 older adults

27 year old professional cyclist referred for palpitations

- Echocardiogram
- Bicycle maximal exercise stress test
- 24 hour Holter Monitor electrocardiogram

~ No restrictions, continued dialogue with cardiovascular specialist, athlete monitoring symptoms, monitoring blood pressure (monitor for hypertension if > 130/80 mmHg)

Cardiovascular Care of the Athlete-Issues

- Syncope = Transient loss of consciousness accompanied by loss of postural tone
- Common in trained athletes
- Majority attributed to neurocardiogenic mechanisms (post exertion)

Syncope during intense exercise relates to possible malignant arrhythmia, structural/valvular heart disease, or myocardial ischemia

Baggish AL, Wood MJ. Circulation 2011;123:2723-2735

Miracle at the Barry Roubaix: Survival of the Fittest

38 year old cyclist collapsed- A heart attack mid-race, right alongside a cemetery, but in view of several trained medics, who kept up CPR until an ambulance arrived. Miracle? Maybe. Lucky? Absolutely.

Diagnosis: Myocardial bridge – Heart artery problem

Brush Ridge Cemetery, where G collapsed. © Geoffrey Bernard

www.cxmagazine.com/barry-roubaix-heart-attack-story

Cardiovascular Conditions Associated with SCD in Athletes

- Hypertrophic cardiomyopathy
- Sarcoïdosis
- Myocarditis
- Arrhythmogenic Right Ventricular Cardiomyopathy
- Dilated Cardiomyopathy
- Long – QT syndrome
- Short-QT syndrome
- Wolff-Parkinson-White syndrome
- Brugada syndrome
- Catecholaminergic polymorphic VT

Baggish AL, Wood MJ. Circulation 2011:123:2723-2735


"Red Flags" from History/Interview

- Sudden Infant Death Syndrome (SIDS) + Genetic overlap
- Unexplained sudden death age < 50y
- Syncope/pre-syncope (fainting)
- Exercise intolerance (short of breath, chest pain)
- “Heart attack”
- Seizures
- Heart transplant
Echocardiogram
Electrocardiogram

+ Enhance screening questionnaire, history and physical elements
+ Combined have been shown to detect cardiac abnormalities

Grenier MA et al. An Echo Screening Tool for SCD in Young Athletes. JASE Abstracts 2013 P1-105
Corrado D et al. JACC 2006;52:1981-9
Jureidini SB et al. Aberrant coronary arteries; a reliable echocardiographic screening method. JASE 2003;16:756-76

Cardiovascular Conditions Associated with Sudden Death in Athletes

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Goals for Screening-All Ages

Risk Stratification + Risk Management

Normal
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Abnormal
- Further evaluation, assessment, consideration
- No defined perfect “screening” evaluation exists
  Echo: ?
  MRI: ?

Performance Enhancement Agents

+ World Anti-Doping banned medication list
  Cardiovascular medications including beta blockers, adrenergic agonists, diuretics, stimulants
+ Injectable insulin, human growth hormone, creatine → Unknown cardiovascular effects
+ Caffeine/stimulants → Exacerbate palpitations
+ Erythropoietic stimulants → Microvascular infarction
+ Androgenic anabolic steroids → Dyslipidemia, exaggerated exercise BP response, myocardial dysfunction

Northeastern (Veneto) region of Italy

Baggish AL, Wood MJ. Circulation 2011;123:2723-2735
Sample ECGs – Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC)

A. Diffuse ARVC
B. Localized ARVC
C. ARVC with RBBB pattern
TWI indicates T-wave inversion

Differential Diagnosis – Intermittent Claudication

Vascular
+ Atherosclerosis
+ Popliteal artery entrapment syndrome
+ Cystic adventitial disease of the popliteal artery
+ Iliac artery endofibrosis
+ Fibromuscular dysplasia
+ Venous claudication
+ Large- and medium-vessel vasculitis

Nonvascular
+ Chronic exertional compartment syndrome
+ Arthritis (lumbosacral spine, hip or knee)
+ Peripheral neuropathy
+ Hamstring muscle tightness
+ Symptomatic popliteal (Baker) cyst
+ Plantar fasciitis

18 year old cyclist referred for evaluation of leg pain

Unexplained left leg symptom - painful & swollen thigh at maximal effort
+ Started cycling age 14, 10,000 K / year
+ 18 month history of symptom
+ No response to physiotherapies

P Abraham et al. Circulation.1999; 100: e38

Arterial Duplex Assessment


Iliac Artery Endofibrosis - Histology

18 year old cyclist with leg pain

**External iliac artery endofibrosis**
- Cyclists > runners > x-country skiers > triathletes
- Average age of presentation 25 years
- 1986 series of 23 cyclists with condition
- 15% with bilateral presentation
- Surgery with artery shortening/resection of endofibrotic segment + saphenous vein patch or interpositional graft
- Endovascular approach with angioplasty
- Stop particular activity

Perlowski A; Jaff M. Vasc Med 2010 15: 469

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**Sudden Death Unrelated to Cardiovascular Disease**

**Commotio Cordis**
- Latin Agitation of the heart
- Chinese martial art of Dim Mak (or touch of death)
- Predilection for younger age groups; children and adolescents
- Minnesota registry documents 224 cases/15 years

Maron BJ, Estes N III. N Engl J Med 2010;362:917-927

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**Stop-Frame Images of a Fatal Commotio Cordis Event in a 14-Year-Old-Boy**


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**Pathophysiology of Commotio Cordis.**


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**OhioHealth Sports Cardiology**

Partnership with OhioHealth Sports Medicine

1. Maximize Basic Screening (AHA guideline)
2. Expedite referral process for athletes with symptoms or abnormal screen
3. Education for parents/coaches/school systems on early recognition/therapy (hands only CPR, AED placement)
4. Advanced Screening: Echo and EKG

www.ohiohealth.com/sportsmed-screenings/
Heart and Vascular Health for Cyclists

Conclusions

- Evidence supports athletics and sport as overall cardioprotective
- Know your athletes / prepare for events
- Respect
  - Viral illness/fever
  - Changes in the athlete’s body
  - Day of the competition
- Referral
- Learn Hands Only CPR
- Identify AED at sports sites/events, understand and get trained to use

European Society of Cardiology Congress
Amsterdam, September 2013

Mortality of French participants in the Tour de France (1947–2012)

The cyclists had a 41% lower mortality rate than men in France

Marijon E et al. Eur Heart J 2013;34:3145-3150

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“The bottom line here is: Intense activity on a bike is not associated with increased risk.”

- Donna Arnett, PhD, immediate past president of the American Heart Association, chair of epidemiology at the University of Alabama at Birmingham, commenting to Ed Susman, Contributing Writer, MedPage Today

www.medpagetoday.com/MeetingCoverage/ESC

Thank you

Questions: Anne.Albers@OhioHealth.com
Resources: www.hearthealthdocs.com